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STOMACH CONTENTS OF SPINY DOGFISH (*Squalus acanthias*) CAUGHT NEAR THE QUALICUM AND FRASER RIVERS, APRIL-MAY, 1980-1981

by

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ABSTRACT

Robinson, C.K., L.A. Lapi, and E.W. Carter. 1982. Stomach contents of spiny dogfish (Squalus acanthias) caught near the Qualicum and Fraser Rivers, April-May, 1980-1981. Can. MS Rep. Fish. Aquat. Sci. 1656: iii + 21 p.

Stomach contents of spiny dogfish (Squalus acanthias) caught near the Qualicum and Fraser rivers were examined to determine if dogfish were feeding on salmonids. No salmonids were found in the stomachs of dogfish, but salmon fry were found in the stomachs of incidentally caught coho (Oncorhynchus kisutch) and chinook salmon (O. tshawytscha).

Key words: diet, dogfish, coho salmon, chinook salmon, chum salmon, Fraser River, Qualicum River, predation.

RESUME

Robinson, C.K., L.A. Lapi, and E.W. Carter. 1982. Stomach contents of spiny dogfish (Squalus acanthias) caught near the Qualicum and Fraser Rivers, April-May, 1980-1981. Can. MS Rep. Fish. Aquat. Sci. 1656: iii + 21 p.

On a analysé les contenus stomacaux d'aiguillats (Squalus acanthias) capturés près du fleuve Fraser et de la rivière Qaulicum pour savoir s'ils se nourrissaient de salmonidés. Les estomacs des aiguillats ne contenaient aucun salmonidé, mais on a trouvé des alevins de saumon dans les estomacs de saumons quinnat (O. tshawytscha) et coho (Oncorhynchus kisutch) capturés accidentellement.

Mots-clés: régime alimentaire, aiguillat, saumon coho, saumon quinnat, saumon kéta, fleuve Fraser, rivière Qualicum, prédation.

INTRODUCTION

Spiny dogfish have long been considered a nuisance by salmon fishermen because of the damage they cause to gear and because they are believed to compete with salmon for food. In the minds of many they are also voracious predators of salmon. An earlier study of dogfish by Chatwin and Forrester (1953) showed that predation on salmonids near the Fraser was rare in May at the time of the annual eulachon run.

April, the study time for the Qualicum River, coincided with previously noted seaward migration times for fry of chum (Oncorhynchus keta), chinook (O. tshawytscha), and coho salmon (O. kisutch) and smolts of coho and steelhead trout (Salmo gairdneri). Smolts would be in relatively low numbers this early in the year (Anonymous 1961; Anonymous 1962; Minaker et al. 1979; Sandercock and Minaker 1975; Walker and Lister 1965). May, the study time for the Fraser River, coincided with previously noted seaward migration time for smolts of steelhead, coho, and sockeye (O. nerka) and fry of chum and pink salmon (O. gorbuscha) (Bailey and Fraser 1978). However, pink salmon fry would be relatively rare since 1981 is an off year for their production.

The purpose of this study was to determine if spiny dogfish (Squalus acanthias) prey upon juvenile salmonids leaving the Qualicum and Fraser Rivers (Appendix Table 1-Common and scientific names).

This report contains the methods, results, and analysis of this study. Detailed records including bridge logs, individual stomach contents, length-frequencies of key species, and gonad conditions of dogfish are contained in Robinson et al. (In press).

METHODS

On May 26, 1980, the M/V STAR ROCK, a fisheries patrol vessel, was used to collect samples of dogfish caught by the commercial salmon gillnet fleet in the mouth of the Fraser River (Statistical Area 29-B; Fig. 1). On April 15-21 and May 6, 1981 the seiner M/V WINDWARD STAR was chartered to catch dogfish from the Little Qualicum River to Metcalf Bay, hereafter referred to as 'Qualicum River area' (Fig. 2). The same vessel was chartered May 3-5, 1981 to fish off the Fraser River (Canoe Passage to the North Arm jetty, Statistical Area 29-A, Fig. 1, 3). Whenever a successful set for dogfish was made, repeated sets were made in the same vicinity.

A herring seine net was used for all sets but eight in the Qualicum River area. A salmon seine net was used in shallow waters. In the Fraser River area strong river and tidal currents often made fishing difficult.

All species caught, and estimates of their abundance, were recorded. All dogfish were measured for total length to the nearest millimetre, sexed, and examined for gonad maturity. The stomachs (excluding the spiral valve) were cut open and the contents identified. It was noted whether each item appeared fresh or digested. Total volume of the contents of

each stomach was then measured in a graduated cylinder. This was accurate to within 10% of the true volume. Volume of larger pieces was estimated by eye. This was accurate to within 20% of the true volume. In instances where water was apparently ingested during capture, the volume of water was not included in the total volume. Specimens which were not immediately indentifiable were fixed in 10% formalin and stored for later examination.

All living salmon were immediately released from the seine with dip nets. Dead salmon were measured for fork length to the nearest millimetre, sexed, and examined for stomach contents. Samples kept for other investigations included spines taken from dogfish collected by the M/V STAR ROCK.

RESULTS

In 1981, 52 seine sets were completed-36 near the Qualicum River (April 15-21; May 6) and 16 near the Fraser River (May 3-6) (Fig. 2, 3). Nineteen species of fish and invertebrates were caught in the purse seines during 1981-13 in the Fraser River area and 15 in the Qualicum River area. Table 1 summarizes the biological data collected from each species, by area.

QUALICUM RIVER AREA

A total of 366 dogfish stomachs were sampled in the Qualicum River area (Table 2). Fourteen percent of all stomachs were empty-10% of juveniles and 38% of adults. The principal food item of juveniles was larvacea (Oikopleura sp.-a microscopic invertebrate belonging to phylum chordata). Principal food items of adults were adult pollock, adult herring, ctenophores, and jellyfish. None of the dogfish contained anything identifiable as salmonid.

Five percent of all dogfish caught in the Qualicum River area were mature fish and 52% were female. The modal total length of juveniles was 39 cm and the modal total length of adults was 77 cm. The range in total length for all dogfish caught in the Qualicum River area was from 27 to 114 cm (Fig. 4).

A total of 121 coho stomachs were examined and 26% were empty (Table 3). Principal food items were euphausiids and gastropoda (Limacina helicina-small snails). A variety of larval fish were also found, notably chum and pink salmon fry, lingcod (Ophiodon elongatus), and herring. Modal fork length of the coho was 44 cm, and the size range was 33 to 47 cm (Fig. 5).

A total of 27 chinook stomachs were sampled and 41% were empty. Principal food items were chum salmon fry, larval herring, Pacific sandlance (Ammodytes hexapterus), euphausiids, and adult herring. Chinook fork length ranged from 29 to 72 cm (Fig. 5).

Other species sampled for stomach contents were Pacific herring, walleye pollock, Pacific cod, and plainfin midshipman (Table 4). No salmonids were found in any of these species.

FRASER RIVER

A total of 137 dogfish stomachs were sampled in the Fraser River area, 81 in May 1980 and 56 in May 1981 (Table 2). Sixty-seven percent of all stomachs were empty-65% of juveniles (<60 cm total length) and 69% of adults. Principal food item was eulachon (Thaleichthys pacificus) in 1980 and 1981. Thirteen dogfish contained unidentifiable digested fish in 1980 and 1981 but none of these contents, nor any other stomach contents, were identifiable as salmonid.

The 1980 sample had a larger proportion of mature fish (1980-13%, 1981-5%) and a larger proportion of females (1980-43%, 1981-20%) than the 1981 sample. The 1980 fish ranged in total length from 51 to 91 cm and the 1981 fish ranged from 24 to 83 cm (Fig. 4). The gillnet gear selected for larger fish, hence the size and maturity differences between the 1980 and 1981 samples.

One coho and three chinook stomachs were sampled and found to contain euphausiids, eulachon, and unidentifiable digested matter.

DISCUSSION AND CONCLUSIONS

QUALICUM RIVER

Salmon fry were demonstrated to be in the waters of the Qualicum River area as they were found in the stomachs of coho and chinook salmon. Chum fry was the principal food item of the chinooks (found in 19% of those which contained food) and chum and pink fry comprised 7% (5% and 2%, respectively) of the coho stomach contents. On the other hand, as the dogfish did not contain anything identifiable as salmonid, it is unlikely that they are major predators of chum fry in the Qualicum River area at this time of year. Juvenile dogfish were feeding primarily on zooplankton and the adults were feeding primarily on adult pollock, adult herring, ctenophores, and jellyfish.

FRASER RIVER

Seine catches were generally poor off the Fraser River. This was partly due to strong currents which lowered the fishing efficiency of the net. Seining off the Fraser yielded an average of 3.5 dogfish/set, one-third the average yield for the Qualicum River area sets (10.5 dogfish/set). This lower catch rate, although partly due to the difficulties with the net, was probably also due in part to a relative scarcity of dogfish in the upper water column off the Fraser. This scarcity, at a time when salmonid fry and smolts are leaving the river, as well as the fact that all the dogfish stomachs

sampled did not contain anything identifable as salmonid, indicates that dogfish in the Fraser River area are probably not major predators of salmonids at this time of year.

ACKNOWLEDGMENTS

The authors would like to thank the officers and crew of the M/V WINDWARD STAR for their assistance, fishing expertise, and patience. We would especially like to acknowledge the expertise of skippers Marvin Warnock and Richard Johnson. We also thank John Fulton and Dr. John Mason for helping to identify many of the stomach contents. We thank John Richards of the Province of British Columbia, Marine Resources Branch, and the crew of the M/V STAR ROCK for collecting data from the gillnet fleet. Some of the scientific staff were employed by the Province of British Columbia, Ministry of Environment.

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Table 1. Catch (numbers) and inventory of biological samples collected in the Qualicum and Fraser River areas, April-May, 1980-1981.

	Qualicum River area						
Species	Catch	Length	Sex	Maturity	Age	Stomach	Other
Lamprey	1	-	-	-	-	-	Fixed in 10% formalin
Dogfish	367	366	366	366	-	366	-
American shad	-	-	-	-	-	-	-
Pacific herring	4200E	12	-	-	-	13	-
Coho salmon	250E	121	119	-	-	121	-
Chinook salmon	50E	25	25	-	-	27	-
Eulachon	-	-	-	-	-	-	-
Plainfin midshipman	50E	1	-	-	-	1	-
Pacific cod	2	2	-	-	-	2	-
Pacific hake	370E		-	-	-	-	-
Pacific tomcod	1		-	-	-	-	-
Walleye pollock	2500E	24	24	-	-	24	30 to live tank
Arrowtooth flounder	-	-	-	-	-	-	-
Starry flounder	2	-	-	-	-	-	-
Squid	7	-	-	-	-	-	-
Shrimp	-	-	-	-	-	-	-
Euphausiid	P	-	-	-	-	-	-
Ctenophore	P	-	-	-	-	-	-
Jellyfish	P	-	-	-	-	-	-

Table 1 (cont'd)

Species	Fraser River - 1981						
	Catch	Length	Sex	Maturity	Age	Stomach	Other
Lamprey	1	-	-	-	-	-	Fixed in 10%
	-	-	-	-	-	-	formalin
Dogfish	56	56	56	56	-	56	-
American shad	3	-	-	-	-	-	-
Pacific herring	2500E	-	-	-	-	-	-
Coho salmon	16[a]	1	1	-	-	1	-
Chinook salmon	22E	3	3			3	
Eulachon	100E	-	-	-	-	-	-
Plainfin midshipman	1	-	-	-	-	-	-
Pacific cod	-	-	-	-	-	-	-
Pacific hake	200E	-	-	-	-	-	-
Pacific tomcod	-	-	-	-	-	-	-
Walleye pollock	3	-	-	-	-	-	-
Arrowtooth flounder	1	-	-	-	-	-	-
Starry flounder	19E	-	-	-	-	-	-
Squid	-	-	-	-	-	-	-
Shrimp	1	-	-	-	-	-	-
Euphausiid	-	-	-	-	-	-	-
Ctenophore	-	-	-	-	-	-	-
Jellyfish	1	-	-	-	-	-	-

Table 1 (cont'd)

Species	Fraser River - 1980						
	Catch	Length	Sex	Maturity	Age	Stomach	Other
Lamprey	-	-	-	-	-	-	-
Dogfish	83	83	82	82	80b	81	-
American shad	-	-	-	-	-	-	-
Pacific herring	-	-	-	-	-	-	-
Coho salmon	-	-	-	-	-	-	-
Chinook salmon	-	-	-	-	-	-	-
Eulachon	-	-	-	-	-	-	-
Plainfin midshipman	-	-	-	-	-	-	-
Pacific cod	-	-	-	-	-	-	-
Pacific hake	-	-	-	-	-	-	-
Pacific tomcod	-	-	-	-	-	-	-
Walleye pollock	-	-	-	-	-	-	-
Arrowtooth flounder	-	-	-	-	-	-	-
Starry flounder	-	-	-	-	-	-	-
Squid	-	-	-	-	-	-	-
Shrimp	-	-	-	-	-	-	-
Euphausiid	-	-	-	-	-	-	-
Ctenophore	-	-	-	-	-	-	-
Jellyfish	-	-	-	-	-	-	-

P=Present
E=Estimate
a=Includes fish identified only as 'salmon', not definitely Coho.
[b]=Spines

Table 2. Stomach contents of juvenile (<60 cm total length) and adult dogfish collected in the Qualicum and Fraser River areas, April-May, 1980-1981. Percentage occurrence of food remains expressed as a percentage of the total occurrences, excluding 'unidentifiable'. Stomach contents listed in overall order of occurrence.

	Qualicum River area				Fraser River - 1981				Fraser River - 1980			
	Juvenile		Adult		Juvenile		Adult		Juvenile		Adult	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fish examined	324		42		43		13		20		61	
Fish with empty stomachs	34	10	16	38	29	67	8	62	12	60	43	70
Stomach contents												
Unidentifiable zooplankton	262[f]	51	3[f]	11	1	11	-	-	-	-	-	-
Larvacea	220	43	1	4	-	-	-	-	-	-	-	-
Unidentifiable fish remains	1	0.2	5	19	1	11	-	-	4	67	8	42
Euphausiid	13	3	-	-	2	22	-	-	1	17	1	5
Eulachon	-	-	1	4	5	56	4	100	-	-	-	-
Ctenophore and jellyfish	2	0.4	5	19	-	-	-	-	-	-	-	-
Adult pollock	-	-	6	22	-	-	-	-	-	-	-	-
Leaves and twigs	-	-	-	-	-	-	-	-	-	-	6	32
Adult herring	-	-	5	19	-	-	-	-	-	-	-	-
Larval herring	4	1	-	-	-	-	-	-	-	-	-	-
Crab	-	-	-	-	-	-	-	-	1	17	3	16
Amphipod[a]	4	1	-	-	-	-	-	-	-	-	-	-
Polychaete[b]	4	1	-	-	-	-	-	-	-	-	-	-
Plainfin midshipman	2	0.4	-	-	-	-	-	-	-	-	-	-
Prawn	-	-	-	-	-	-	-	-	-	-	1[g]	5
Clam[c]	1	0.2	-	-	-	-	-	-	-	-	-	-
Tapeworm[d]	-	-	1	4	-	-	-	-	-	-	-	-
Unidentifiable[e]	18	3	2	7	5	36	1	20	4	40	5	21
Total volume (mL)	1385		1072		133		155		-		-	

[a] Included Parathemisto pacifica.
[b] Tomopteris septentrionalis except for one Rhychonerella angelina in the Qualicum River area.
[c] Possibly horse clam (Tresus capax).
[d] Likely a parasite rather than a food item (Chatwin and Forrester 1953).
[e] Percentage of occurrences expressed as a percentage of the total occurrences.
[f] Included unidentifiable zooplankton and Nanomia sp.
[g] Not definitely identified.

Table 3. Stomach contents of chinook and coho salmon collected in the Qualicum and Fraser River areas, April-May, 1981 by M/V WINDWARD STAR. Percentage occurrence of food remains expressed as a percentage of the total occurrences excluding 'unidentifiable'. Stomach contents listed in overall order of occurrence.

	Qualicum River Area				Fraser River - 1981			
	Chinook		Coho		Chinook		Coho	
	No.	%	No.	%	No.	%	No.	%
Fish examined	27		121		3		1	
Fish with empty stomachs	11	41	31	26	1	33	0	0
Stomach contents								
Euphausiid	4[b]	15	30[e]	25	1	50	-	-
Unidentifiable zooplankton	1	4	31	26	-	-	-	-
Limacina helicina	-	-	19	16	-	-	-	-
Larval herring	4	15	8	7	-	-	-	-
Chum salmon fry	5[c]	19	6	5	-	-	-	-
Juvenile lingcod	-	-	9	8	-	-	-	-
Cottid	2	7	3[f]	3	-	-	-	-
Pacific sandlance	4	15	-	-	-	-	-	-
Tomopteris septentrionalis	-	-	4	3	-	-	-	-
Amphipod	2[d]	7	1[g]	1	-	-	-	-
Adult herring	3	11	-	-	-	-	-	-
Pink salmon fry	-	-	2	2	-	-	-	-
Unidentifiable larval fish	-	-	2	2	-	-	-	-
Sagitta elegans	1	4	1	1	-	-	-	-
Stichaeid	1	4	-	-	-	-	-	-
Pholid	-	-	1	1	-	-	-	-
Eulachon	-	-	-	-	1	50	-	-
Squid	-	-	1	1	-	-	-	-
Aglantha sp.	-	-	1	1	-	-	-	-
Unidentifiable[a]	-	-	19	14	-	-	1	100
Total volume (mL)	158		524		13		1	

[a]Percentage of occurrences expressed as a percentage of the total occurrences.

[b]Included *Euphausia pacifica*.

[c]Included nine salmon fry of which eight were chum and one was not definitely identified.

[d]Included *Cyphocaris challengeri*, *Euprimno* sp., and *Calliopius* sp.

[e]*E. pacifica* and *Thysanoessa spinifera*.

[f]Included one Irish lord (*Hemilepidotus* sp.)

[g]Included *Parathemisto pacifica* and *C. challengeri*.

Table 4. Stomach contents of fish other than dogfish or salmon collected in the Qualicum River area by M/V WINDWARD STAR (April-May 1981). Percentage occurrence of food remains expressed as a percentage of the total food occurrences.

	Pacific herring				Plainfin midshipman		Pacific cod		Walleye pollock	
Set no.	12		27		22		13		25	
Type of sample	Total catch		Largest ones sampled		Total catch		Total catch		1 randon bucket	
Mean length (cm)	-		25.1		26.7		69.0		42.9	
	No.	%	No.	%	No.	%	No.	%	No.	%
Fish examined	1	-	12	-	1	-	2	-	24	-
Fish with empty stomachs	0	0	0	0	0	0	0	0	1	4
Stomach contents										
Adult herring	-	-	-	-	-	-	2	100	-	-
Crab	-	-	-	-	1	100	-	-	-	-
Euphausiids	1	100	9	75	-	-	-	-	23	100
Unidentifiable zooplankton	-	-	3	25	-	-	-	-	-	-
Total volume (mL)	-		37		25		80		65	

Appendix Table 1. Scientific and common names of species referred to in this report.

Common name	Scientific name
American shad	*Alosa sapidissima*
Arrowtooth flounder	*Atheresthes stomias*
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Eulachon	*Thaleichthys pacificus*
Lamprey	Agnatha
Pacific cod	*Gadus macrocephalus*
Pacific hake	*Merluccius productus*
Pacific herring	*Clupea harengus pallasi*
Pacific tomcod	*Microgadus proximus*
Plainfin midshipman	*Porichthys notatus*
Spiny dogfish	*Squalus acanthias*
Starry flounder	*Platichthys stellatus*
Walleye pollock	*Theragra chalcogramma*
Ctenophore	Ctenophora
Euphausiid	Crustacea
Jellyfish	Scyphozoa
Shrimp	Crustacea
Squid	*Loligo* sp.

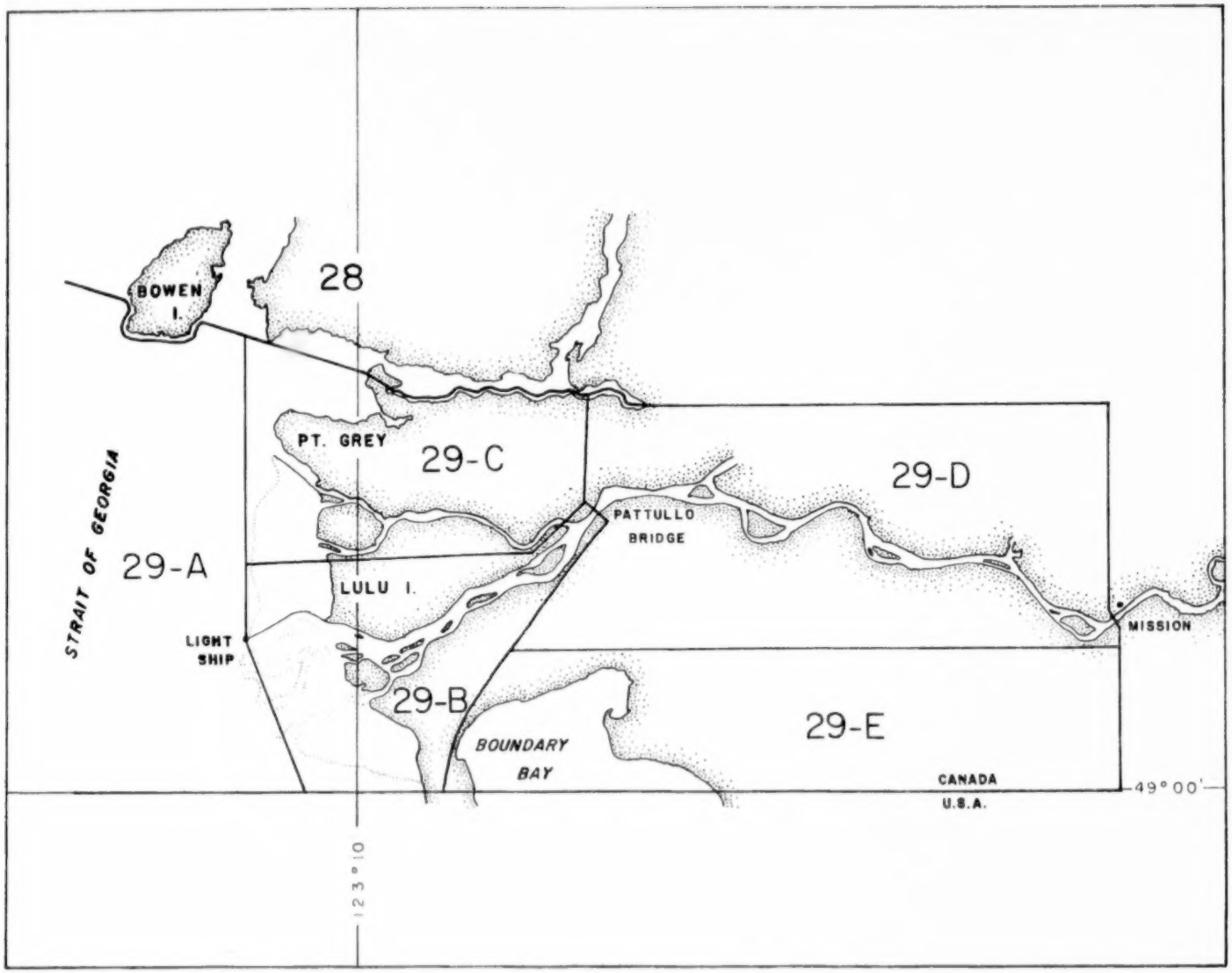

Fig. 1. Statistical areas 29-A to 29-E, the Fraser River area.

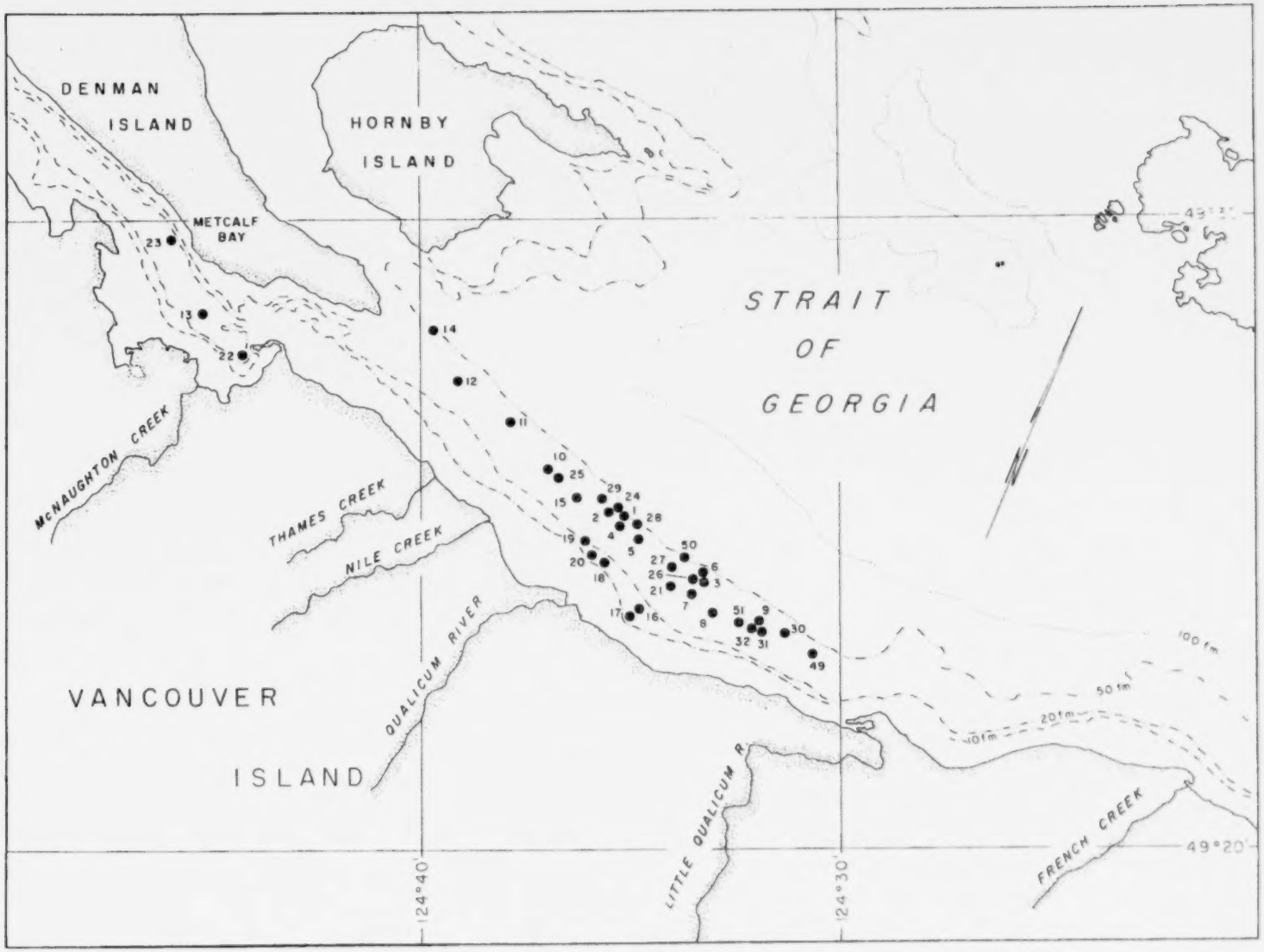

Fig. 2. Set locations of M/V WINDWARD STAR in the Qualicum River area (April-May, 1981).

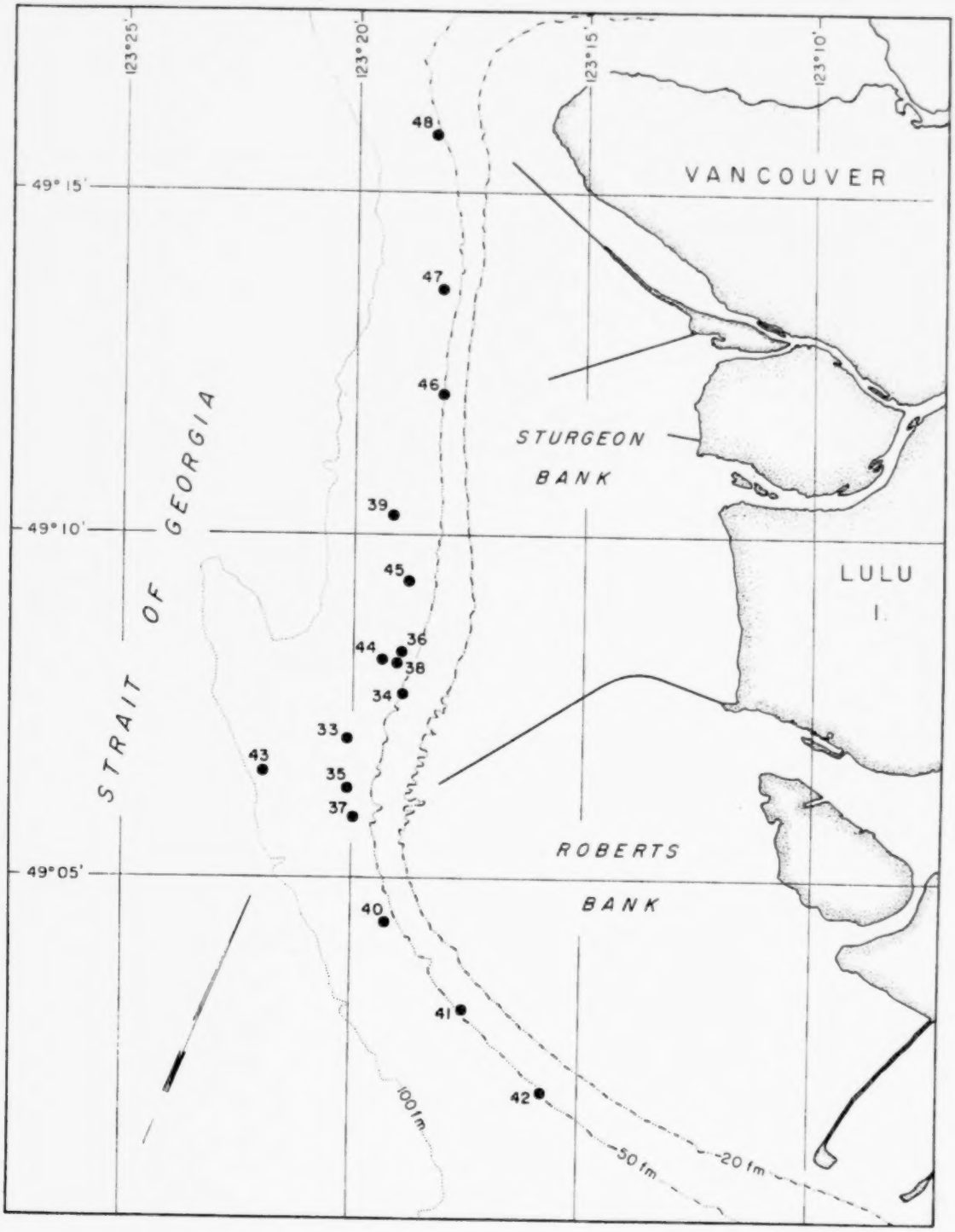

Fig. 3. Set locations of M/V WINDWARD STAR in the Fraser River area (May, 1981).

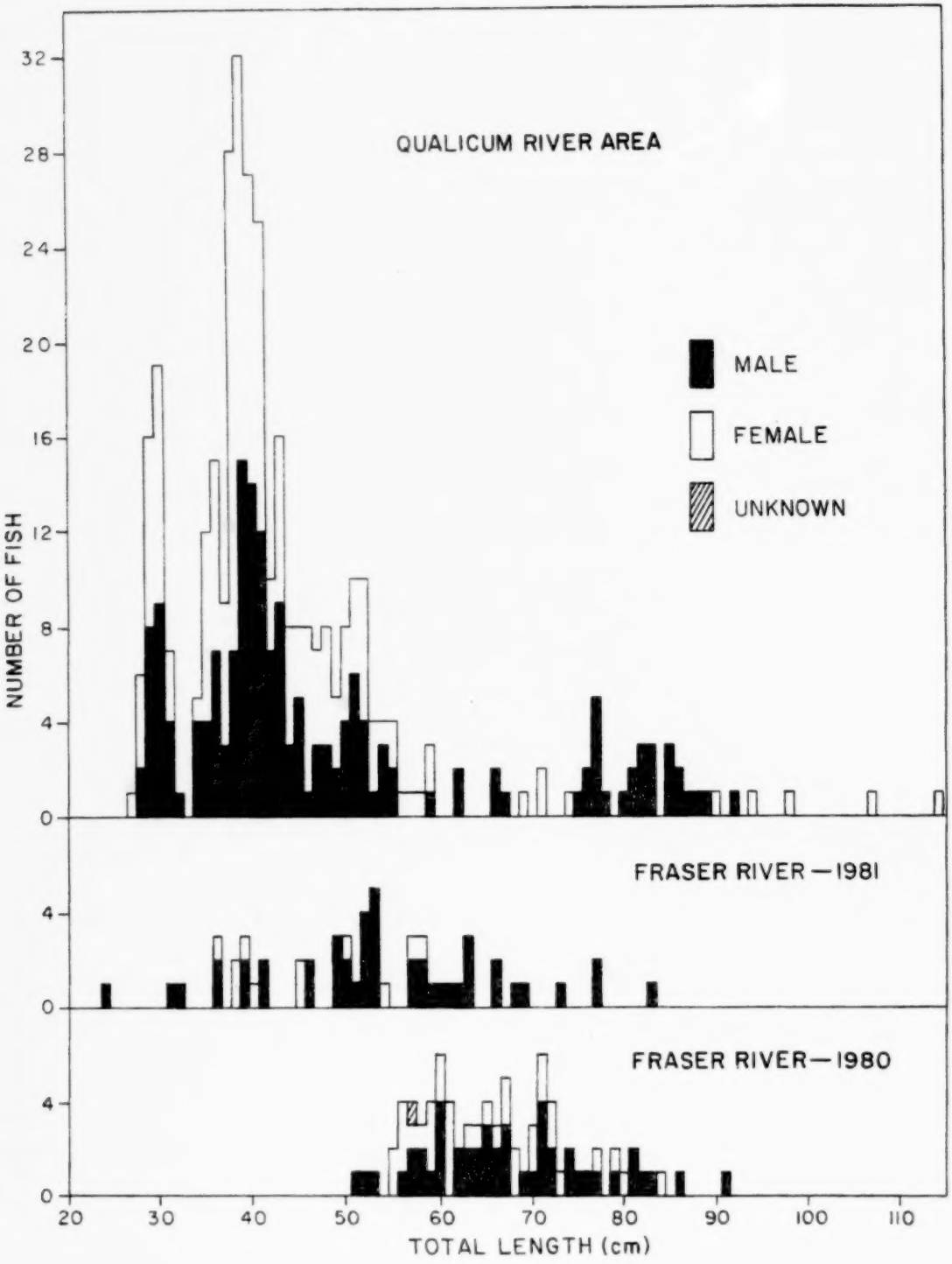

Fig. 4. Length-frequency of dogfish collected in the Qualicum River area (April-May, 1981) and in the Fraser River area (May, 1981 and May, 1980).

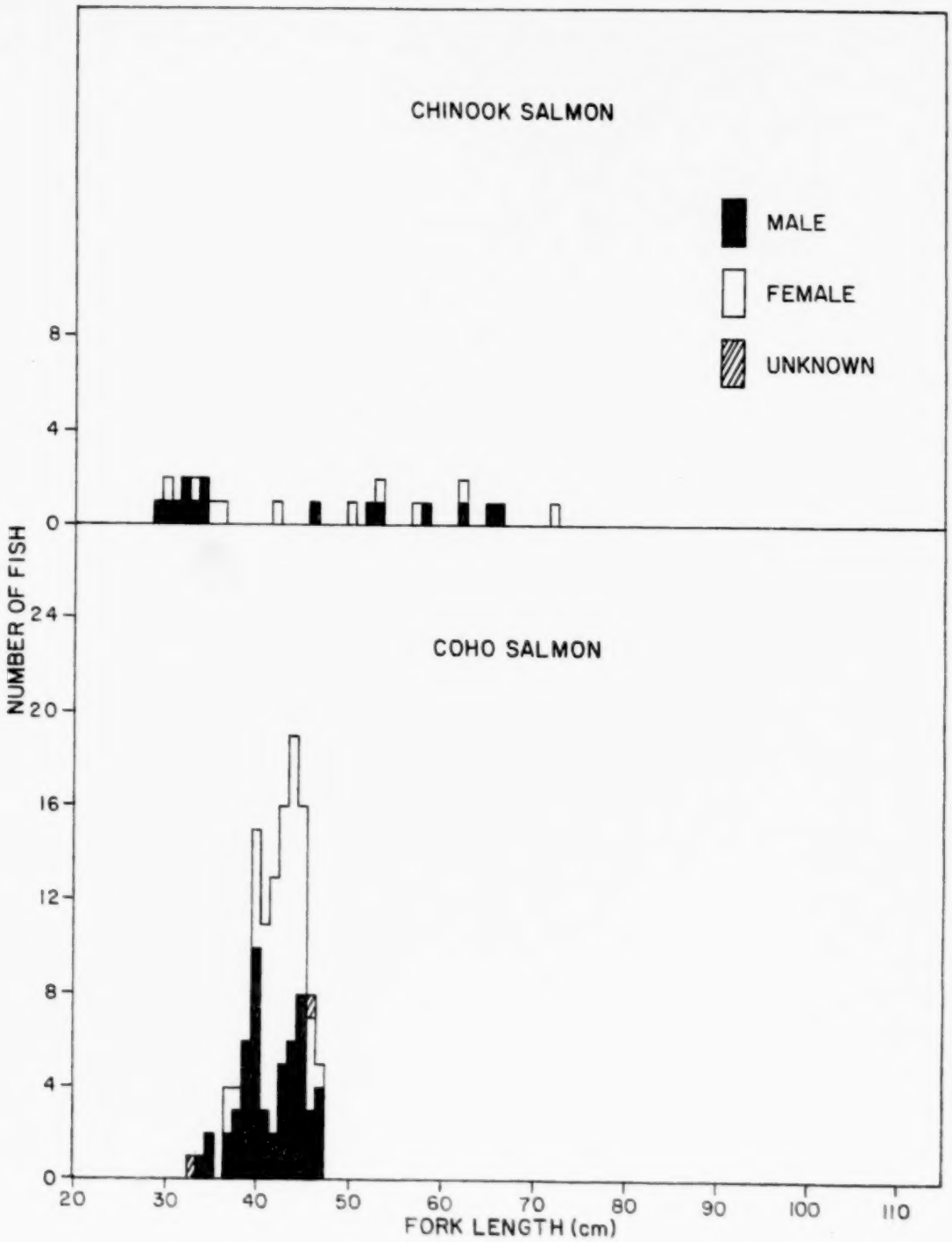

Fig. 5. Length-frequency of chinook and coho salmon collected in the Qualicum River area (April-May, 1981).